

## **Meeting 12/21/05      SRC Subcommittee on Laser Safety**

Present: Ted de Castro (EH&S), Larry McLouth (EHS), Robert Schoenlein (MSD), Eddie Ciprazo (UCB), Joel Ager (MSD), Ken Barat (LLNL).

### **Agenda:**

- (1) Update on recent laser safety issues and laser laboratory closures (Ted, Larry)
- (2) Overview of EH&S response to recent laser safety issues (Larry)
- (3) Discussion of the treatment of laser amplifiers and whether they should be included in the laser inventory database. (The underlying issue is to determine what is required by DOE, and to define what purpose or utility we expect to be provided by the database.)
- (4) Discussion on the use of transparent beam tubes for laser enclosures
- (5) Discussion of proposed policy defining LBNL laser safety responsibilities on campus
- (6) Update on AHD database (Larry)

### **Minutes:**

(1) Larry and Ted provided a brief overview of the recent laser safety issues that were discovered during the DOE audit of the laser inventory database, and subsequent visits to laser labs. Problems included (i) inaccurate information and missing information in the inventory. (ii) interlocks disconnected from class IV lasers, and (iii) modifications to access/exit doors by the laser users that violated the conditions for operation described in the AHD. The issue of preventing interlocks from being disconnected was raised. For now, this will be handled administratively via the periodic laser lab visits by the LSO, and by re-emphasizing to laser users and safety supervisors that required interlocks must be in place for the operation of class IV lasers.

(2) Larry provided a brief summary of the EH&S response to DOE/BSO.

### **Highlights include:**

- (i) Additional personnel have been added to the laser safety program. Larry McLouth is now the Laser Safety Program Manager (LSPM), reporting to Paul Blodgett. Ted de Castro is the Laser Safety Officer, with final responsibility for technical decision and judgments related to laser safety.
- (ii) Comprehensive field inspections of all LBNL laser laboratories will be conducted by the LSO, LSPM, and relevant Division Safety Coordinator
- (iii) A laser safety consultant will be retained to look at the laser safety program
- (iv) A task force will be established to standardize laser system interlocks and installation procedures.

There was some comment and discussion of the EH&S response to DOE.

Regarding the verification of the laser inventory, LBNL EH&S needs to define exactly what information is to be required (by LBNL and by DOE) for the inventory (and presumably would be the basis for verification) and what information is optional. In its present form, the inventory includes significant additional information such as beam size, power, divergence, wavelength, pulse duration etc. which while useful, may be impractical to verify for every laser at LBNL. It was suggested that hazard classification by laser class be sufficient for inventory

purposes. More detailed laser hazard information is provided in the individual AHDs, and this is not possible to capture in a simple inventory.

Regarding (iii), the point was made that for the consultant to be effective, he should be familiar with laser safety issues and practices as they apply to individual-investigator scale research environments (in contrast to industrial laser facilities or large-scale laser research facilities).

Regarding (iv), it was suggested that the task force focus on establishing the minimum standard installation requirements (e.g. conduit?, emergency crash buttons?, redundant switches? etc.) and benchmarking the installation costs. The experience of laser users has been that these requirements and costs seem to vary considerably from one installation to the next, with the same issues often being re-visited for each interlock installation.

### (3) Laser Amplifiers

This issue relates to the question of what the basic requirements are for the laser inventory. There was considerable discussion of this. Beyond satisfying a DOE requirement, the laser inventory serves several functions. First, it provides a very rough catalog of the laser hazards. However, there was general agreement by the committee that this inventory is not a comprehensive catalog of the laser hazards at LBNL. For example, it does not provide sufficient information to determine what laser eyewear might be required, what access controls might be required, how they might be implemented etc. Such a comprehensive description of the laser hazards is uniquely provided by the relevant laser AHD's.

Bob Schoenlein reported on discussions of the issue of laser amplifiers with several laser users. In general, since amplifiers do not have an independent power supply, their characteristics depend critically on the characteristics of the pump laser and on the seed beam being amplified. As a result, listing amplifiers in the inventory, independently, without describing the associated pump/seed lasers, is not particularly useful from a safety perspective. In addition, coming up with a suitable definition of an amplifier is problematic. Some amplifiers are essentially Q-switched lasers (e.g. regenerative amplifiers), others are frustrated laser cavities (e.g. multi-pass amplifiers), still others are simple non-linear crystals (e.g. single or multi-pass parametric amplifiers) and are indistinguishable from non-linear crystals used for frequency doubling etc.

A proposal was made to include a "light hazard table" in all laser AHD's. Although not yet completely defined, the idea of this table is to provide a comprehensive list of the light hazard conditions (wavelength, power, pulse duration etc.) associated with any laser activity. The table would provide sufficient information for the LSO to determine the minimum eyewear requirements for a particular lab. Redundant light hazards would not be entered, but only the highest level hazard encountered for that wavelength, pulse duration etc. In addition, this table could be cross-referenced to the laser inventory, and automatically populated with the light hazards associated with the "lasers" from the inventory database, then augmented with the additional light hazards arising from various amplifiers or non-linear optical processes.

The preliminary recommendation of the committee is to include only Class IIb and Class IV "lasers" in the laser inventory. An important action item for the next meeting will be to agree on a workable definition for "laser". The committee also expressed support for including a standard "light hazard table" in laser AHD's. A second action item for the next meeting is to agree on the format, contents etc. of such a table.

(4) Ted de Castro presented the general arguments for allowing transparent beam tubes as laser enclosures. The committee agreed, that under certain circumstances, transparent tubes are suitable as laser beam enclosures and there is no fundamental reason to disallow them. However, the suitability of transparent tubes as enclosures relies entirely on the details of how they are to be used, aligned, installed etc. to insure that the laser beam is properly enclosed, and that it cannot be diverted (e.g. by an upstream optic) at a sufficient angle to propagate through the wall of the tube. It will be up to the individual laser user to describe in detail (in the AHD) how the tubes are to be used, and it will be up to the LSO to verify that the use of transparent tubes is appropriate for any given installation.

(5) There was general agreement on the proposed policy defining LBNL laser safety responsibilities on campus. Some minor revisions and clarifications were suggested, these will be incorporated, and the draft policy re-circulated. The committee did not formally agree on a recommended policy, and this will be discussed at future meetings. One important consideration is a pending DOE report on EH&S that may address this issue. The laser safety subcommittee will try to incorporate relevant parts of this report in any policy recommendation.

(6) The AHD database will be rolled out gradually, in consultation with the division safety coordinators, as the laser inspections are completed, and as AHD's come up for renewal.